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Modified Stoppa's Approach Versus Ilio Inguinal Appraoch For Anterior Column Fractures Of Acetebulum In A Tertiary Care Hospital

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ABSTRACT

BACKGROUND AND OBJECTIVE: Acetabular fractures are complex injuries that present a surgical challenge due to the deep location and complex anatomy of pelvis. Modified Stoppa approach has emerged as an alternative approach to the traditional ilio-inguinal technique, offering improved exposure of the fracture site, reduced intraoperative blood loss, shorter operative duration, and potentially fewer complications. This study aims to compare Modified Stoppa's approach with Ilioinguinal approaches for blood loss during the surgery, operative time, postoperative complications, and functional outcomes in patients undergoing surgical fixation for anterior acetabular fractures.

METHODOLOGY: This cross sectional analytical study was conducted in department of Orthopaedic surgery Lahore General Hospital, Lahore from 1st Nov. 2022 to 30th Nov. 2023.

RESULTS: Mean operative time in Stoppa,s group was 92 ± 10 as compared to 110 ± 12 in Ilioinguinal group which was statistically significant (P < 0.001). Hemoglobin drop was 1.5 , compared to Ilioinguinal group which was also statistically significant (P = 0.04). Harris Hip score was in excellent in Stoppa group and was 17 (51.5) , compared to 16 (48.5) in Ilioinguinal group (p > 0.05).

CONCLUSION: Modified Stoppa,s approach can be used as alternative approach for surgical management of anterior acetabulum fractures due to visualization of fracture site, less blood loss, short operative duration, better fracture reduction and less complication rate.

KEY WORDS: Anterior Acetabulum, Modified Stoppa Approach, Ilioinguinal Approach, Intraoperative blood loss

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INTRODUCTION

Acetebulum fractures occur as a result of high speed trauma.[1] Mostly this result in unstable fractures and are associated with other major vessels & visceral injuries like bladder, urethra, rectum and vaginal injuries.[2] Unstable fractures are also result of low energy trauma in osteoporotic bone while in young patients low energy trauma result in stable fractures.[3] These fractures can be associated with internal & external degloving. Mortality rate from these injuries from 10-50%. As the injury severity score increases ,associated injuries ,shock and Head injury result in death of the patient while late death occur as a result of sepsis.[4] Multi organs failure and thromboembolic complications are among causes of late death. A multidisciplinary approach consisting of orthopedic surgeon with assistance of anesthesia consultant and general surgeon is needed to treat acute acetabular fractures Judet & Letournal were the pioneer of complex orthopaedic surgery.[5] Their research provided the guidelines about the different radiological tool and about surgical approaches.[6]

For unstable fractures X –rays pelvis with both Hip joints AP & Lateral views including Judet views and CT Scan of Pelvis should be done. Reformatted 3-D CT Scan allows better visualization and analysis of fracture geometry. In addition to it patient should undergo Chest X-RAYS, abdominal Ultrasonogram &peritoneal lavage. For acute unstable fractures initially apply the Pelvic binder or External fixator during the Resuscitation phase.[1]

The treatment of Acetebular fractures are difficult because of complex anatomy and surgical approach used to treat these fractures.[7] Due to the proximity of neurovascular, visceral structures and complex anatomy of pelvis, there are higher chances of damage these structures. Other important factors are patients' factors, fracture pattern, degree of articular cartilage involvement and Hip instability.[8] The purpose of treatment whether operative or non-operative, is pain relief, early mobility of the patient and prevention of Hip arthritis on long term basis. Acetabular fractures are intra articular fractures of hip joint which is an important weight bearing joint. It requires accurate reduction, adequate fixation and early post- operative rehabilitation.[9]

Normally the conservative treatment is adopted for displaced fractures of less than 2mm displacement even if it is involving the weight bearing area. Skin traction is applied for 6-12 weeks and x-rays are taken at 2 weeks interval to see whether the fracture has any displacement of fracture. Conservative treatment is also adopted for fractures with significant displacement if they are not important prognosti-

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cally. Moreover patients who are medically unfit, patients with multisystem injuries and in elderly patients with severe osteoporosis should also be treated conservatively if there is biomechanical instability. Fracture involving the weight bearing area with fracture fragment displacement of more than 2mm. fracture dislocation and posterior acetabular fragment of size of more than 40%-50% of posterior wall then the patient should be treated surgically. Roof arc measurement of more than 45 degree in one of the three views AP & two oblique views, also another indication for surgical treatment.10 Before going for surgical treatment, fracture pattern should be clearly defined and classified. The most commonly used classification system is by Judet & Letournal. In 90% of cases, five commonly encountered fracture pattern are both Column Fractures: Anterior column involving the iliopectineal line and posterior column involving the ilio-ischeal line. The characteristic feature of both column fracture is spur sign which means Acetabulum can no longer bear the weight of the upper body. Transverse Fractures-Shaped Fractures, Transverse Fractures & Posterior Wall fracture, Isolated Posterior Wall Fractures.

A lot of surgical approaches in addition to minimally invasive techniques are used to fix anterior column acetabular fractures. Each having its own advantages & disadvantages. These are the Ilioinguinal approach, Extended ilio femoral approach, Trans articular & Tri radiate approach and modified Stoppa approach.[11] Whatever approach is used, it should provide the adequate visualization of fractured area, fracture fragment reduction and precise fixation of these fragment. In addition to it patient Heath status and associated co morbidities also matters. Moreover, it also depends upon the experience of the surgeon for particular approach being used. One of the best approaches to fix anterior acetabular fracture is Modified Stoppa approach. Initially this approach was used by Rives et al. and Stoppa et al to treat the complicated inguinal Hernia, in 1993 with some modifications this technique was used by Hirvensalo to fix Quadrilateral plate fracture of acetabulum. In 1994 Cole and Bolhofner used this approach to visualize Sciatic buttress and Quadrilateral plate.[11]

The present study would definitely guide us about best approach for acetabulum fracture in terms of fracture exposure, blood loss, duration of surgery and overall complications.

METHODOLOGY

This analytical cross sectional study was carried out at Lahore General Hospital from 1st November 2022 - Nov 30, 2023 after obtaining approval from the Institutional Ethical Review Board. A total of 46 patients diagnosed with acetabular fractures were included, using a non-probability purposive sample technique. After getting informed & written consent from all participants, patients were divided into two equal groups: Group A (23 patients) underwent fracture fixation using the Modified Stoppa approach, while Group B (23 patients) was treated with the Ilioinguinal approach. Intraoperative details such as blood loss, operative duration, quality of fracture reduction, postoperative complications, and functional outcomes were systematically recorded for each patient. Blood loss was evaluated by comparing preoperative and postoperative hemoglobin levels measured on the second postoperative day. Operative duration was calculated from the initial skin incision to the final closure of the surgical wound. The accuracy of fracture reduction was assessed through postoperative CT scans using standardized digital measurements in axial, coronal, and sagittal planes; a step-off or gap ≤2 mm in the weight-bearing area was considered an anatomical reduction. All patients were followed postoperatively at intervals of 6 weeks, 3 months, 6 months, and 1 year. Follow-up imaging included pelvic X-rays at each visit and a CT scan at 2 weeks to evaluate the quality of reduction and detect any displacement. Functional outcomes were assessed at each follow-up using the Harris Hip Score (HHS), which classifies hip function as excellent (90–100), good (80–89), fair (70–79), or poor (<70). A standardized rehabilitation protocol was followed: non-weight-bearing for the first 6 weeks, partial weight-bearing with crutches starting at 6 weeks, and full weight-bearing at 3 months using a single crutch for an additional 6 weeks. Postoperative complications such as infection, neurovascular injury, and heterotopic ossification were carefully monitored and documented throughout the follow-up period.

All data were assessed by using SPSS version 23. Continuous variables like age, operative time, blood loss, and Harris Hip Scores, were expressed as mean ± standard deviation (SD). Categorical variables, including gender, mechanism of injury, fracture type, and complication rates, were presented as frequencies and percentages. The Student's t-test was used to compare normally distributed continuous variables between the two groups. The Chi-square test was used for comparing categorical variables, such as gender distribution and complication rates. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 46 patients with acetabular fractures were included in the study and divided into two groups: Group A (Modified Stoppa approach) & Group B (Ilioinguinal approach), with 23 patients in each group. There was no statistically significant difference between the groups in terms of age, gender distribution, or fracture pattern ($p > 0.05$).In Group A, there were 14 anterior column fractures, 6 bi-

Table I: Baseline Characteristics & Fracture Pattern

Variable		*Group A (Stoppa)*	*Group B (Ilioinguinal)*	*p-value*
Age (years)		40.2 ± 13.4	45.1 ± 14.2	0.19
Gender	Male	14 (60.9)	9 (39.1)	0.54
	Female	16 (69.6)	7 (30.4)	
Anterior Column Fracture		14 (53.8)	12 (46.2)	0.721
Bi-column Fracture		6 (50.0)	6 (50.0)	
Transverse Fracture		3 (37.5)	5 (62.5)	

column fractures, and 3 transverse fractures. In Group B, there were 12 anterior column fractures, 6 bi-column fractures, and 5 transverse fractures. The distribution was comparable and noted statistical difference between groups ($p > 0.05$).

The mean operative duration in Group A was 92±10 minutes, whereas in Group B, it was 110±12 minutes which was statistically significant ($p < 0.01$), indicating a shorter operative time with the Modified Stoppa approach. Blood loss was assessed by the difference in preoperative and postoperative haemoglobin levels. The mean preoperative Hb level was 12.2±1.0 g/dl in Group A and 12.0±2.0 g/dl in Group B. The mean drop in Hb on the 2nd postoperative day was 1.5 g/dl in Group A & 3.0 g/dl in Group B which was statistically significant ($p = 0.04$), suggesting higher perioperative blood loss in the Ilioinguinal group. In Group A, the corona mortis vessel was identified in 18 patients and ligated, was not visualized in 3 patients, and was inadvertently injured in 2. In Group B, the vessel was identified in 15 patients, damaged in 6, and not visualized in 2. Although not statistically compared, a trend toward higher vessel injury was observed in Group B. The external iliac vein was injured in 1 patient in Group A and in 2 patients in Group B, was not statistical significance ($p = 0.55$). The lateral femoral cutaneous nerve was injured in 2 patients in Group A and in 5 patients in Group B ($p = 0.27$), indicating a higher rate of nerve injury in the Ilioinguinal group. Superficial soft tissue infection occurred in 3 patients in Group A and in 5 patients in Group B. All infections were managed with antibiotics and debridement, with complete healing observed within 12 weeks postoperatively. The difference in infection rate was not statistically significant ($p = 0.44$).

Table II: Operative and Perioperative Outcomes

Parameter	*Group A (Stoppa)*	*Group B (Ilioinguinal)*	*p-value*
Operative Time (minutes)	92 ± 10	110 ± 12	0.001*
Preoperative Hemoglobin (g/dL)	12.2 ± 1.0	12.0 ± 2.0	0.46
Hemoglobin Drop (g/dL)	1.5	3	0.04*
External Iliac Vein Injury (n)	1 (33.3)	2 (66.7)	0.55
	22 (51.2)	21 (48.8)	
Lateral Femoral Cutaneous Nerve Injury (n)	2 (28.6)	5 (71.4)	0.27
	21 (53.8)	20 (46.2)	
Soft Tissue Infection (n)	3 (37.5)	5 (62.5)	0.44
	20 (52.6)	18 (47.4)	

**P-value< 0.05 will be considered as statistically significant*

Postoperative CT scans were used to assess the quality of reduction using standardized digital methods, with a step-off <2 mm considered anatomical. In Group A, good anatomical reduction was obtained in 18 patients while it was unsatisfactory in 5. In Group B, anatomical reduction was seen in 17 patients, satisfactory in 2, and unsatisfactory in 4. No statistically significant difference in reduction quality was found between groups ($p = 0.34$).Clinical and radiological fracture healing was observed in all patients Sby the 12th postoperative week in both groups. Harris Hip Score(HHS) was used to assess the functional outcomes at the final follow-up (1 year). In Group A, 17 patients had excellent scores, 4 had good, and 2 had fair outcomes (range 72–98). In Group B, 16 patients had excellent outcomes, 4 had good, and 3 had fair (range 71–99). The difference between groups was not statistically significant ($p = 0.89$). In Group A,the mean hip flexion was 104±13.5 degrees while in Group B, it was 105±11 degrees ($p = 0.60$). Mean hip extension was 11.32±7.22 degrees in Group A and 10.98±7.00 degrees in Group B ($p = 0.44$). These differences were not statistically significant.

Table III: Comparison of Postoperative Radiological Quality, Functional Outcomes, and Hip Range of Motion Between Modified Stoppa and Ilioinguinal Approaches

Fracture Reduction Quality	*Group A (Stoppa)*	*Group B (Ilioinguinal)*	*p-value*
Anatomical Reduction (<2 mm)	18 (51.4)	17 (48.6)	0.34
Satisfactory Reduction (2 –3 mm)	0 (0.0)	2 (100)	
Unsatisfactory Reduction (>3 mm)	5 (55.6)	4 (44.4)	
Harris Hip Score			
Excellent	17 (51.5)	16 (48.5)	0.89
Good	4 (50.0)	4 (50.0)	
Fair	2 (40.0)	3 (60.0)	
Range of Motion			
Hip Flexion (° mean ± SD)	104 ± 13.5	105 ± 11.0	0.60
Hip Extension (°mean ± SD)	11.32 ± 7.22	10.98 ± 7.00	0.44

DISCUSSION

Acetabular fractures are among the most complex orthopedic injuries due to their anatomical intricacy and the high risk of intraoperative and postoperative complications. These fractures are often associated with polytrauma, including visceral, spinal, and femoral injuries. Traditionally, the ilioinguinal approach has been widely used for anterior column fractures, particularly by experienced orthopedic surgeons. However, in recent years Modified Stoppa approach has achieved popularity as it offers simplified access

to the anterior column and hemi-transverse fractures with potentially fewer complications.[10]

In this comparative study, we evaluated intraoperative, perioperative, and postoperative parameters in two patient groups undergoing surgical management for acetabular fractures—one treated with the Modified Stoppa approach and the other with the ilioinguinal approach. Both groups were demographically similar, with a higher incidence of male patients likely due to increased exposure to high-energy trauma. Age and mechanism of injury were also comparable between the groups.[11]

Our findings showed that patients in Group A (Modified Stoppa) had significantly shorter operative durations and reduced intraoperative and perioperative blood loss compared to Group B (ilioinguinal). Neurovascular complications, including injury to the lateral femoral cutaneous nerve and external iliac vein, were also less frequent in the Modified Stoppa group. Additionally, the rate of postoperative infection was lower in Group A. Despite these differences, both groups demonstrated similar fracture healing times and functional outcomes as assessed by the Harris Hip Score (p=0.6). The quality of fracture reduction was comparable as well, with no statistically significant difference in anatomical alignment on postoperative CT scans.[12]

These findings are consistent with several previous studies. Srivastava et al., in a systematic review and meta-analysis of 717 patients, concluded that the Modified Stoppa approach is associated with less blood loss, short operative duration, and low complication rate, while maintaining comparable functional outcomes to the ilioinguinal approach. Similarly, M. Scrivano et al. reported reduced operative time and lower rates of neurological complications and infections with the Modified Stoppa approach. Al Adawy et al. also identified the Modified Stoppa approach as more convenient and effective in minimizing intraoperative and postoperative complications.[13]

K. Mahmood et al., in their meta-analysis, and Aziz AMA, in a retrospective study, echoed these conclusions, emphasizing the Modified Stoppa approach's advantages in blood loss reduction, fracture site visualization, and ease of access for anterior column fractures. Both studies found functional outcomes to be equivalent to those achieved with the ilioinguinal approach.[14]

Our study supports the growing body of evidence suggesting that the Modified Stoppa approach offers significant intraoperative advantages without compromising radiological or functional outcomes. This approach can thus be considered a reliable alternative to the ilioinguinal method, particularly in cases involving anterior acetabular fractures.

CONCLUSION

The Modified Stoppa approach has emerged as a reliable and effective alternative for managing anterior acetabular fractures. It demonstrated reduced intraoperative and perioperative blood loss, shorter operative duration, and improved direct visualization of the fracture site, facilitating better reduction. Despite these technical advantages, the clinical and radiological outcomes including fracture healing and functional scores were comparable between the Modified Stoppa and Ilioinguinal approaches. These findings support the use of the Modified Stoppa approach as a viable and often preferable option, especially in anterior column and associated fracture patterns.

Limitations: Our study included some cases of bi-column fractures, which may have introduced variability in outcomes despite attempts to match fracture types across groups. The sample size was relatively small, and the follow-up period was limited to one year. A larger, multicenter trial with long-term follow-up is recommended to evaluate complications such as post-traumatic arthritis and long-term functional performance.

Ethical Approval: Ethical Review Committee Lahore General Hospital, Lahore, allowed vide letter No.172/82/ERB dated 11-10-2022.

Conflict of Interest: None

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MAH, TM: Data Collection and manuscript drafting.

MSH,WS : Data Analysis and critical review, Supervision & Manuscript drafting & proof reading.

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